quate and inconvenient, but the space available in the museum has become much too restricted, while both offices and museum, with all their valuable accumulations, are subject to danger of loss by fire. The advantage to Canada of having an adequate display of the mineral wealth of the country can scarcely be exaggerated, and that the museum, even in its present state, possesses much interest to the general public, is evidenced by the fact that more than 26,000 visitors have been registered during the year.

UNIVERSITY AND EDUCATIONAL NEWS.

YALE UNIVERSITY receives $200,000 through the marriage of Mrs. T. C. Sloane. Mr. Sloane had left part of his estate as a trust fund, the above amount to go to Yale University in case of Mrs. Sloane's second marriage.

THE will of the late Ephraim Howe leaves $40,000 to Tufts college for a new building to be known as the Howe memorial.

THE New York *Evening Post* states that the library of Cornell University has secured, by purchase, through the Sage endowment fund, the extensive collection of works on South America gathered, mainly during an eight years' residence in Brazil, by Herbert H. Smith, of the Brazilian Geological Commission.

IT is understood that Edinburgh University will receive £20,000 from the estate of the Earl of Moray as an endowment fund for the promotion of original research in the University.

THE Senate of the Glasgow University has conferred the degree of D. D. on Prof. Thiselton-Dyer and on Prof. Andrew Gray.

THE St. Petersburg Medical Academy has received from the Russian government $2,500 for experiments with the X-rays.

DISCUSSION AND CORRESPONDENCE.

CERTITUDES AND ILLUSIONS.

EDITOR OF SCIENCE: I am very much afraid that physicists will find themselves utterly unable to follow, or, at least, to understand, Major Powell in his philosophical dissertations on the fundamental concepts of mechanics, and that they will be compelled to conclude that his philosophy is *not* 'Natural' Philosophy, in the generally accepted sense.

Believing this to be inevitable, it is hardly worth while to continue at any length a discussion or critical examination of the very interesting propositions which he has laid down. It may be of use, however, to invite his attention to the fact that in the answers to my questions relating to 'Rest and Motion,' which he gave in this JOURNAL for April 17th, he continues to ignore entirely the only serious issue raised by them. It can hardly be supposed that Major Powell is undertaking to establish a concept of motion independent of relativity, yet he seems to overlook the necessity of giving it consideration. When, in answer to my question, he defines motion as 'change of position' it only leaves the question where it was before, if not in even greater obscurity. 'Position' implies a relation; then motion implies a relation and cannot be predicated of any one of Major Powell's several orders of units.

His statement that "the speed of a particle is constant in reference to itself at different times" is meaningless, if the commonly accepted idea of motion is correct. If it is not correct, and that of Major Powell is, then—the bottom has dropped out.

As to his suggested correction of a typographical error in his previous statement relating to the velocity of light, if *molar* be substituted for *molecular* in that statement, it remains quite as astounding as before. I mention this only that he may note that apparently he has not detected the real absurdity involved. M.

APRIL 19, 1896.

IS THERE MORE THAN ONE KIND OF KNOWLEDGE?

"My praise shall be dedicated to the mind itself. The mind is the man, and the knowledge of the mind. A man is but what he knoweth. The mind itself is but an accident to knowledge, for knowledge is a double of that which is. The truth of being and the truth of knowing is all one."—Praise of knowledge.

I am pleased to find in the current number of SCIENCE (April 3, 1896), that after seven months

of irrelevant discussion on side issues, one of your readers (M. M.), has at last found the thesis of my article on Science and Poetry (SCIENCE Oct. 4, 1895,) worthy of consideration.

While I take issue with M. M., I thank him for this opportunity to give, once more, my reasons for the belief that is in me that there is only one kind of knowledge and but one way to acquire it.

I hope I may be permitted to say, in introduction, that I have no sympathy with those who hold that science is inductive or nothing. I yield to no one in reverence for mathematics. I wish it had been my good fortune to be more familiar with the deductive or 'abstract' sciences, for I believe they are the best products of the human mind. I am prepared to stake everything on their axioms, for I believe they are ἄξιοι, or worthy of all confidence. I accept the logical deductions from them as the best and most trustworthy of all knowledge.

All this is quite a different matter from the admission that these axioms rest on anything but evidence; that they are 'necessary;' or that we have any way to deduce new truth from them except the employment of that empirical *logic of events*, which is based on evidence and knowledge of the order of nature. I am acquainted with no evidence that the mind is anything more than 'an accident to knowledge,' or that knowledge is any thing but 'the double of that which is.'

In his comment on my assertion that *the test of truth is evidence* and nothing but evidence, M. M. admits that evidence is a requisite test for *nearly all* truths. I infer from this qualification that he believes there are some truths for which evidence is not necessary.

If this means that some truths are already supported by so much evidence that no more is needed, I have nothing to say; but I take it that he believes with Hume, that certain truths 'are discoverable by the mere operation of thought, without dependence on what is anywhere existent in the universe.'

His words are not very explicit; and if this is not his meaning I beg his pardon, and I ask leave to address this communication to those readers of SCIENCE, if any there be, who do believe in 'necessary truths.'

Like most students of the order of nature, I feel my own unfitness to contend in argument with one trained in dialectic, and I shall, therefore, attempt no more than a brief statement of what I believe to be the opinion of most of my scientific contemporaries concerning those conceptions which are called axioms, innate ideas, intuitive beliefs or necessary truths.

When we ask proof that these conceptions are innate we get no direct evidence, but we are told we must admit this, since we cannot conceive their contrary. As M. M. acknowledges that 'inconceivability is no test of falsity,' he, at least, cannot make this reply; for, if his words mean anything they mean that inconceivable things may be true. We have no way to discriminate between unknown things, and anything which may be true may some time prove true.

If there were any reason to believe the human mind is a finished instrument, perfect, and a measure of the unknown, the argument, that these beliefs are necessary because we cannot conceive their contrary, might seem valid; but no one who believes 'the subtilty of nature is far beyond that of sense or of the understanding' can admit that this proves they are necessary in any sense of the word except the practical one. We are able to spin fancies out of our minds as a spider spins silk out of its stomach, but I hope most readers of SCIENCE agree that "all this is but a web of the wit; it can work nothing." I hope they agree, also, that the difference between truth and fancy is evidence.

We say, glibly enough, of this quintessence of dust: "What a piece of work is man? How noble in reason! how infinite in faculties! in apprehension how like a god!" But it is perhaps fortunate for our self esteem that we have no opinion on the subject by any competent judge; and it is the height of folly to attempt to measure the unknown by our own minds.

We are told, furthermore, that reasoning is impossible unless these 'necessary' truths are admitted, and that, if they should ever cease to hold good, the result would be madness and destruction. This may be true, for all I know, but if the human race is ever overwhelmed in

this way it will not be the first, for the rocks are filled with the remains of races which have been destroyed because their internal adjustments failed, at last, to correspond to the order of nature, after a long period of more or less perfect agreement.

There is no direct evidence that the conceptions in question are innate. The indirect evidence from the inconceivability of their negation is worthless, because of the imperfection of our minds. The statement that thought is impossible without them is no assurance that our race may not, like many races which have gone before, some time find itself where the old order changes. Finally the modern student finds still a fourth reason for questioning the necessity of these ideas; the fact that evidence is adequate to account for them, and that the assumption that they are innate is unnecessary.

"It is impossible to prove that the cogency of mathematical first principles is due to anything more than these circumstances; that the experiences with which they are concerned are among the first which arise in the mind; that they are so incessantly repeated as to justify us, according to the ordinary laws of ideation, in expecting that the associations which they form will be of extreme tenacity; while the fact that the expectations based upon them are always verified finishes the process of welding them together. Thus, if the axioms of mathematics are innate, nature would seem to have taken unnecessary trouble, since the ordinary process of association appears to be amply sufficient to confer upon them all the universality and necessity which they actually possess."

Your correspondent M. M. complains that my assertion, that the only test of truth is evidence, gives him 'a slight feeling of dizziness,' as if it were something radical and revolutionary. He may be interested to know that about 2500 years ago Heraclitus warned his fellowmen of the danger of seeking truth in their own little worlds instead of the great and common world, while Bacon gives more energetic expression to the same conviction in the following words:

"This is a rotten and pernicious idea or estimation that the majesty of man's mind suffers diminution, if it be long and deeply conversant with experiences. * * And this opinion or state of mind received much strength from another *wild and unfounded* opinion, which held that truth is innate in the mind of man and not introduced from without, and that the senses rather excite than inform the understanding."

Most students of the principles of science admit that the mind of man has not yet attained to knowledge of causes, but that it has, so far, discovered nothing except a little of the order of nature. The reason why events, either mental or physical, occur in one order rather than another is a mystery which is absolutely unsolved. We can say no more of them than that "they appear together, but we do not know why."

If this is true it is clear that we are in no position to say of any event that it *cannot* be true in the absence of any other event. "The distinction between the necessary and the sufficient condition for the truth of a statement," which M. M. seeks to establish, has therefore no warrant in our knowledge of nature; for while we may seek to 'govern nature in opinion we are thrall unto her in necessity.'

Whether there be such a thing as *formal* logic, distinct from the empirical logic of events, or not, I believe my associates are pretty well agreed that all attempts to make practical application of formal logic have ended in failure. "The two ways of contemplation are not unlike the two ways of action commonly spoken of by the ancients; the one pleasant and smooth in the beginning and in the end impassable, the other rough and troublesome in the entrance but after a while fair and even. So it is in contemplation; if a man will begin with certainties, he shall end in doubts, but if he will be content to begin with doubts he shall end in certainties.

"Once on a time there were two brothers. One was called Prometheus, because he always looked before him and boasted that he was wise beforehand.

"The other was called Epimetheus, because he always looked behind him and did not boast at all, but said humbly, like the Irishman, that he would sooner prophesy after the event.

"Well, Prometheus was a very clever fellow, of course, and invented all sorts of wonderful things, but, unfortunately, when they were set to work, to work was just what they would not

do; wherefore very little has come of them, and very little is left of them; and now nobody knows what they were, save a few archæological old gentlemen who scratch in queer corners.

"But Epimetheus was a very slow fellow, certainly, and went among men for a clod, and a muff, and a milksop, and a slow coach and a bloke, and a boodle, and so forth. And very little he did for many years; but what he did he never had to do over again. Stupid old Epimetheus went working and grubbing on, always looking behind him to see what had happened, till he really learned to know now and then what would happen next, and understood so well which side his bread was buttered, and which way the cat jumped, that he began to make things which would work, and go on working too, till at last he grew as rich as a Jew and as fat as a farmer, and people thought twice before they meddled with him, but only once before they asked him to help them." W. K. Brooks.

April 8, 1896.

THE RETINAL IMAGE ONCE MORE.

I rejoice to learn, in the current number of Science (April 3, 1896, p. 517), that C. L. F. does not include me with the '*Medical Society in Philadelphia*,' and the '*Prominent Baltimore Physician*,' among those '*Distinguished Scientists who think there is anything which needs explanation in the fact that the image on the retina is inverted*;' but as I know no reason why the readers of Science should rejoice with me, I do not care to dwell on the matter.

W. K. Brooks.

ON THE DISAPPEARANCE OF SHAM BIOLOGY FROM AMERICA.

Almost exactly three years ago I contributed to Science* a paper entitled 'On the Emergence of a Sham Biology in America.' In this article I found it necessary to criticise severely the condition of things in some of the leading American universities where courses in zoölogy were permitted to masquerade under the larger title of *Biology*. I protested vigorously against the educational deception which, in at least one important institution—where the official announcement was made that only lack of funds prevented a proper development of botanical science—attempted to cover up this poverty by naming the courses in zoölogy courses in 'biology.' It was pointed out that much harm was done to true biological science by such ignoring of one-half of the science and professing that the moiety remaining was the whole.

Following this article of three years ago was a great outcry against my position from gentlemen professing to represent Johns Hopkins University and Columbia University in the columns of Science, but at the same time I received some half hundred letters of congratulation from both zoölogists and botanists, representing the leading institutions of the country from Harvard to California. In Science for May 26, 1893, I closed the discussion and waited for the outcome, for it was clear that attention to the matter had been excited.

Within a year Chicago University announced the withdrawal of its Department of Biology and the title of Dr. Whitman was changed from Head Professor of Biology to Head Professor of Zoölogy. Following this came the announcement of the creation of a Department of Botany at that institution, and one stronghold had fallen.

This year I learn that on March 2d the Trustees of Columbia University have changed the name of the Department of Biology to Department of Zoölogy, and have altered the titles of the staff to correspond. I am exceedingly gratified at this action which places Columbia upon the reasonable and honest basis. It now remains for the one important institution that is at the same time the greatest offender of all to awaken to its isolated and dishonest position and to cease sending out Doctors of Philosophy in Biology when the botanical work is still in the hands of a tutor and the preponderant stress is laid upon zoölogy. A full professorship of botany should be established at once, requiring no change in staff, but giving a fair recognition to both biological sciences and saving the institution from such spectacles as it had to witness three years ago when its 'biologists' stood up manfully for a sham biology that is now vanishing like mists in the morning.

Conway MacMillan.

* Science, Old Series, 21: 184. 7 Ap., 1893.